INTRODUCTION

In accordance with the foregoing, claims 6-8 and 26 have been amended and new claim 27 has been added. No new matter has been submitted.

Reconsideration of the allowability of the pending claims is respectfully requested.

Claims 1, 6-8, 10-14, and 16-27 are pending, with claims 1, 6-8, 10-19, and 27 being under consideration.

OBJECTION TO CLAIMS 6-8

In view of the Examiner's helpful comments, claims 6-8 have been amended to depend from independent claim 1. Withdrawal of this objection is respectfully requested.

REJECTION UNDER 35 USC 103

Claims 1, 6-8, 10-14 and 16-19 stand rejected under 35 USC 103(a) as being obvious over Patil et al., U.S. Patent No. 6,425,655, in view of Nakamura, U.S. Patent No. 6,211,936, and Asano, U.S. Patent No. 6,396,665.

Similarly, claims 1, 6-8, 10-14 and 16-19 stand rejected under 35 USC 103(a) as being obvious over Komuro et al., U.S. Patent No. 4,873,622, in view of Nakamura, U.S. Patent No. 6,211,936, and Asano, U.S. Patent No. 6,396,665.

These rejections are respectfully traversed.

Prior Art Discussed in the Present Application

The present application explains in detail the differences between an implementation of a hot press welding and an implementation of conventional ultrasonic (thermosonic) bonding techniques. See the background of the present application in paragraphs [0005]-[0006], referencing two US patents, which explain thermosonic bonding, and at least paragraphs [0023]-[0028], which explain hot pressure welding with reference to FIGS. 11-13.

In particular, conventional theremosonic bonding includes applying pressure to two conductors while applying ultrasonic energy. See col. 3, line 56, through col. 5, line 13, of U.S. Patent No. 4,635,073, and col. 2, line 24, through col. 3, line 9, and col. 5, line 65, through col. 6, line 46, of U.S. Patent No. 6,126,271.

The present application explains that hot pressure welding applies a high temperature to

a single point with pressure to generate the weld, e.g., at 300-500C. See paragraph [0023] of the present application. Conversely, in thermosonic bonding the temperature is substantially lower, near 70C. See U.S. Patent No. 4,635,073, col. 5, lines 8-12.

A conventional problem was that substrates were sufficiently fragile that they could not be heated to the higher temperatures for the hot pressure welding, so lower temperatures were used in combination with the ultrasonic energy. However, as noted in the present application, a high pressure welding tool can be made with a pointed heating element for applying pressure and high temperatures directly to the conductors that were being bonded, without harming the substrate.

Thus, the claimed invention implements the use of this different hot pressure welding, which is a particular type of bonding, different from that of thermosonic bonding. The hot pressure welding includes the pointed heating.

As illustrated in FIGS. 11-13, the embodiments of the present invention are improvements over such conventional thermosonic techniques.

In addition, a part of the present invention is the claimed notching, which further simplifies the overall bonding system over conventional techniques. FIG. 10 of the present application provides an example where the notches are generated by a laser, i.e., notching away a protective layer to provide a notched access to the conductor below.

An additional part of the present invention is the physical arrangement of the flexible printed circuit and its placement on substrate 10. For example, the arrangement of the flexible printed circuit in FIG. 4 of the present invention is different from the arrangement of the flexible printed circuit in Patil et al.

Thus, the presently claimed invention utilization of the claimed notches, in conjunction with the claimed high pressure welding, improves over the conventional systems in both simplicity and results.

With this discussion in mind, it is respectfully submitted that it would not have been obvious to modify either Patil et al. nor Komuro et al. to disclose the presently claimed invention, as proffered in the Office Action.

Primary References Patil et al. and Komuro et al.

First, applicants respectfully believe a brief discussion of the focus of each of these two similar primary references will be helpful in understanding the non-obviousness of their modification, as proffered in the Office Action.

In Komuro et al., FIGS. 3 and 5 illustrate two techniques for protecting the bonding positions between the external wiring on a metal frame 19 and an end of wire 27, and between the other end of wire 27 and the pad 26 of the discharge element 18.

The first technique in FIG. 3 illustrates that the bondings are sealed by a sealing agent 17 to enhance reliability. In the second technique of FIG. 5, a resin is molded around the entire structure, after bonding, to encapulate the recording head unit and the metal frame.

In the illustrated examples of Komuro et al., the bonding between the wire 27 and the metal frame 19 or the pad 26 would appear to be either simple soldering or ball wire bonding on contacts generated directly on each of the metal frame 19 and the lead electrode 23 of the discharge element 18. See Komuro et al. in col. 4, lines 19-32.

Regardless, the focus of Komuro et al. is for permitting the protection of the entire bonding area and an electrical connection area: "since the electrical connection area of the discharge and the external wiring unit is resin-molded in a flat and thin shape, the spacing between the orifice plane and the recording paper is reduced and the print quality is improved." Komuro et al., in col. 4, lines 60-65. Here, the sealing technique in the conventional method of sealing the bonding (FIG. 3) would be worn down as the spacing between the orifice plane and the recording paper was reduced.

Similarly, in Patil et al., the focus of the invention is on encapsulating both the bond pads 38 on semiconductor chip 34 and the bonding portions 36 (connection pad on flexible or TAB circuits 26). The primary focus in Patil et al. is on the materials making up the encapsulant, while permitting the encapsulant to also cover both bondings. Patil et al. further explains that the bonding could be accomplished with any of TAB bonding techniques or wire bonding, and may appear to include ultrasonic bonding.

Thus, both Komuro et al. and Patil et al. are focused on improving an encapsulant technique for covering both bondings.

Further, as will be discussed in more detail below, each Komuro et al. and Patil et al. are directed to separate methods of accomplishing and implementing their respective inventions.

In addition, it is respectfully submitted that each reference clearly explains how they accomplish their desired goals. Any proffered modification of the same must still accomplish that goal, without making the same any more complicated or making the accomplishment of that goal less available. For example, if a proffered modification would not provide any substantial advantage over any other method or if the same modification would require substantial changes, or results in increased costs, then the same equally would not have been obvious.

Patil et al.

The Office Action indicates that Patil et al. discloses all the claimed features except that the flexible printed circuit (FPC) has "an opening on the protecting layer (26) through which the bonding portions are exposed in the protection layer and the opening creates a notch for permitting the hot pressure welding of the conductor and the bonding portion," or the claimed hot pressure welding.

To disclose the claimed notch, the Office Action has relied upon Nakamura to disclose the application of heat and Asano for a protection layer through which a bonding portion is exposed in the protection layer.

First, when reviewing Patil et al. it is important to understand that the TAB circuit 26 and the semiconductor chip 34 are originally separate elements that are attached to the underlying body of the cartridge.

Thus, the semiconductor chip 34, which supports the nozzle plate 20, is adhered to the cartridge body 14 with adhesive 50.

Similarly, in a separate manner, TAB circuit 26 is also adhered to cartridge body 14 with adhesive 52.

Thus, FIG. 3 of Patil et al. illustrates that a leading portion of the TAB circuit 26 is adhered (adhesive 52) to the body of the cartridge 14, with such lead portions being directly followed by slotted window portions providing access to TAB electrical traces 32 directly forward of the trailing edge of each slotted window. This leading portion of the TAB circuit 26 is illustrated as being physically between the two bondings.

Further, when the TAB circuit 26 is adhered to the cartridge 14 the slotted windows in the top layer of the TAB circuit 26 provides direct access to the beneath electrical traces 32. These electrical traces 32 only need to extend beyond the trailing edge of each slotted window a

sufficient distance such that the bonding at connection pad 36 can be performed. Further, as discussed in Patil et al. in col. 7, lines 13-16, it is desirable for the encapsulant encircle the bonding and electrical trace 32 to ensure effective protection of the leads.

Similarly, as noted above, the semiconductor chip 34 supports the nozzle plate 20 and is adhered to the cartridge body 14 by adhesive 50. Here, just like with the placement of the TAB circuit 26, there is no need for extending the semiconductor chip 34 toward chip pocket 46, as the semiconductor chip 34 only needs to be placed in a position such that the bonding at bond pad 38 can be performed.

In addition, as noted above, Patil et al. clearly expresses the potential use of the conventional wire bonding or TAB bonding techniques, which could include an ultrasonic method, e.g., the thermosonic techniques mentioned above.

Patil et al. already has a preferred bonding technique, which at least the inventor of Patil et al. believed was a best mode of the same.

Thus, there must be a need or desire for changing the bonding technique performed in Patil et al.

The relied upon motivation in the Office Action is set forth at the bottom of page 3, wherein the Office Action indicates that Nakamura uses a heat press tool to perform a bonding "for preventing the FPC from [being] broken," citing col. 1, lines 56-65.

However, this is incorrect. Nakamura does not perform a similar bonding technique through a heat press tool application, and Nakamura does not provide the general teaching of using the identical application "for preventing the FPC from [being] broken."

Rather, Nakamura discuses that in the use of FPCs in LCD systems there is a 90 degree turn in the FPCs directly after a position where terminals 15 connect to the FPC 61, through an anisotropic conductive film (ACF). This 90 degree turn requires a corner of edge 50 to be removed to prevent the FPC 61 from breaking, i.e., by easing the 90 degree angle into separate smaller angles by rounding the corner of edge 50.

Thus, this application would appear to be specific to a system that may have a 90 degree turn directly after a connection position.

To solve this problem, the inventor in Nakamura added an additional portion to the ACF such that when the signal layer of the FPC was aligned with the ACF, which aligned the same with terminals 15, and upon the application of pressure to connect the same, heat was added.

The added heat acted upon the additional portion of the ACF to cause the same to overflow beyond the terminals 15 toward the 90 degree edge. As the addition portion of the ACF cooled a shelf was generated, element 31. This shelf thereby prevented the 90 degree angle's effect on the FPC, i.e., the FPC would no longer break upon turning downward. In addition, with this method, there was no longer a need a remove a corner of the edge that had previously caused the FPC to break.

Accordingly, the problem and solution in Nakamura is special to the system of Nakamura.

There is no evidence in the record that Patil et al. suffers from any 90 degree turn problem, i.e., there is no evidence that any turns in the FPC 26 of Patil et al. have such a problem. In fact, if such a shelf solution were implemented in Patil et al. the same would probably actually cause more problems to the FPC.

Further, the application of heat in Nakamura does not appear to be for the use of bonding a connector to a pad or conductor. Rather, in Nakamura, the terminals 15 connect to the signal lines of the FPC through the ACF, so no bonding may be necessary. The application of heat, and placement of the heat tool, is used for a generation of the shelf to solve the particular problem in Nakamura.

Thus, the relied upon motivation cited in the Office Action would not be applicable to Patil et al. In addition, the relied upon addition of heat is not a bonding process.

Thus, Nakamura cannot be used to disclose the claimed hot pressure welding.

In addition, the Office Action has further relied upon Asano to disclose a positioning of a protection layer through which a bonding portion is exposed in the protection layer. In particular, the Office Action relies upon FIGS. 7 and 11A-11C to show "a protection layer (80, 82) for protecting a conductor (76), an opening (84) through which the bonding portions (67,68) are exposed in the protection layer (80, 82) for allowing heat to be directly applied to the conductor during soldering," citing col. 3, lines 1-6.

In Asano, FIGS. 7 and 11A-11C illustrate how a pad 64 of a conductor 58 of a main FPC can be connected to a pad 76 of a conductor 81 of a relay FPC 74.

The technique discussed in Asano requires two types of solder, with different melting characteristics, to be deposited on the pad 64 of the main FPC. An inner solder bump 67 with

the higher melting point is enclosed by the an outer solder shell 68, having the lower melting point.

As illustrated in FIGS. 11A-11C, the relay FPC is lowered such that a cover layer 82 of the relay FPC comes into contact with a cover layer 60 of the main FPC, causing the pad 76 of the relay FPC to contact the outer solder shell 68, with levered tension. At this point heat is applied to pad 76, sufficient to melt the outer solder shell 68, but not sufficient to melt the inner solder bump 67. Accordingly, the outer solder shell 68 melts, and the levered tension is released as pad 76 comes into contact with the inner solder bump 67 within the liquid solder from the outer solder shell 68.

Thus, the technique in Asano is for an improved soldering method, and in particular an improved soldering method that requires an additional type of solder and arrangement of the elements such that a pad of a connection member will be properly cantilevered against an outer shell of a first type of solder and then would rest against the second type of solder upon the application of heat.

Here, it is respectfully submitted that Patil et al. would not need or desire this additional modification. It is clear in both the primary references, as well as the aforementioned references cited in the background of the present invention, that the direction of improvements in the connecting of FPCs in the printer field has been through conductor to conductor bonding, without soldering. Thus, this modification of Patil et al. would be counter to the conventional methods. In addition, such a method would require additional elements, including two types of solder, where no solder is currently used, and a particular arrangement between the FPC and the connection member.

In addition, the Office Action's relied upon motivation is to permit heat to be directly applied to the conductor during soldering.

However, in Patil et al., there would not appear to be anything currently preventing the application of heat to the pad and the wire 40. In particular, Patil et al. already sets forth that conventional method of bonding the pad and wire can be performed.

In addition, in discussing the features of Asano, the Office Action references base layer 80 and cover layer 82 for protecting conductor 76, with an opening 84.

However, these elements belong to the **relay** FPC, which could only really correspond to wire 40 in Patil et al., based upon the Office Action's interpretation of Patil et al. corresponding to

the claimed features. However, the claims set forth that the protection layer and conductor are part of the FPC, which in Asano would correspond to the **main FPC**.

Thus, again, to set forth the teachings of Asano with Patil et al., these additional protection layers and conductor arrangement would have to be implemented with the wire 40, which would complicate the invention thereof. In addition, as noted above, it would further require the addition of two solders to the FPC 26 of Patil et al.

Accordingly, it is respectfully submitted that it would not have been obvious to modify Patil et al. as suggested in the Office Action. In addition, it is respectfully submitted that such a modification would not operate as the Examiner intended, or proposed.

Lastly, it s noted that the Office Action has further noted that "although [Asano] does not specify that the opening (84) is a notch; however, a skill artisan realizes that the opening (84) can be shaped as a notch for enhancing the FCB protection during welding or soldering."

However, it is respectfully submitted that there is no evidence in the record supporting this conclusion of what one skilled in the art would do. The Office Action is making conclusions of both evidence that is not in the record, and motivation that is not in the record.

Essentially, the Office Action is setting forth an 'obvious to try' rationale.

However, to set forth a prima facie §103 rejection, there must be some evidenced reason for modifying a reference. Specifically, there must be evidence, outside of the present application, which motivates, leads, or suggests to one of ordinary skill to modify a reference. In particular, an "obvious to try" rationale for combining two references is not valid motivation under 35 USC §103. In re Goodwin, 576 F.2d 375, 377, 198 USPQ 1, 3 (CCPA 1978); In re Antonie, 559 F.2d 618, 195 USPQ 6 (CCPA 1977); In re Tomlinson, 363 F.2d 928, 150 USPQ 623 (CCPA 1966).

Applicants further respectfully request that any following Office Action that sets forth the same rejection support the same through evidence in the record, including an Affidavit from the Examiner if no evidence of the same can be found.

It is further noted that the Office Action has indicated that applicants have not shown any criticality for the aforementioned 'notch' feature, and therefore the same would have been obvious. It is respectfully noted that this rationale is improper. This is not a proper prima facie obviousness rationale, i.e., a particular showing in the record is required of each feature and the corresponding motivation supporting its addition to the underlying reference. Further, applicants

are not required to support the criticality of any one feature, as all features are critical and all features must be found in the art or found to be obvious based upon the proper obviousness rationale. The criticality of any one feature is not relevant, as all features must still be found.

Regardless, as noted above, applicants have particularly pointed out the advantages of this claimed notch feature.

Therefore, for at least the above, it is respectfully submitted that it would not have been obvious to modify Patil et al. as proffered in the Office Action. Withdrawal of this rejection is respectfully requested.

Komuro et al.

Similar to above, the Office Action indicates that Komuro et al. discloses all the claimed features except that the flexible printed circuit (FPC) has "an opening on the protecting layer (26) through which the bonding portions are exposed in the protection layer and the opening creates a notch for permitting the hot pressure welding of the conductor and the bonding portion," or the claimed hot pressure welding.

Further, to disclose the claimed notch, the Office Action has relied upon Nakamura to disclose the application of heat and Asano for a protection layer through which a bonding portion is exposed in the protection layer.

Applicants respectfully submit, for at least similar rationale, it would not have been obvious to modify Komuro et al. as proffered in the Office Action.

In addition, the following is further briefly noted.

Though Komuro et al. discusses implementing bonding, Komuro et al. fails to describe with any detail any relationship between any protection layers and their conductors or whether there would be pads or electrodes generated on both the metal frame and the lead electrode of the discharge element 18.

Further, the described invention of Komuro et al. is **not** discussing the bonding between a lead electrode of the discharge element 18 and a **Flexible Printed Circuit**, but rather the ***bonding between a lead electrode of the discharge element 18 and a substrate made up of the metal frame 19***, with the metal frame 19 having the external wiring unit formed thereon. See Komuro et al. in col. 4, lines 19-32. Komuro et al. briefly discusses the use of a flexible

cable for connecting a driving unit to the substrate having both the discharge element and wiring units in FIG. 1 of Komuro et al., but would not appear to discuss the same again.

Thus, there is no support in Komuro et al. for the structure of the bondings or how the corresponding connection pads interrelate to their respective protective layers, if those protective layers even exist. See Komuro et al. in col. 5, lines 1-7, where Komuro et al. explains that protective layers may not be necessary if there is no potential contact with fluids, also noting that Komuro et al. would only appear to discuss the application of a protective layer for the discharge element 18 and not for the metal frame 19.

Therefore, for at least the above, it is respectfully submitted that it would not have been obvious to modify Komuro et al. as proffered in the Office Action. Withdrawal of this rejection is respectfully requested.

CONCLUSION

There being no further outstanding objections or rejections, it is submitted that the application is in condition for allowance. An early action to that effect is courteously solicited.

Finally, if there are any formal matters remaining after this response, the Examiner is requested to telephone the undersigned to attend to these matters.

If there are any additional fees associated with filing of this Amendment, please charge the same to our Deposit Account No. 19-3935.

Respectfully submitted,

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